

COMPARATIVE APPROACH OF NATM AND DRESS METHOD OF EXCAVATION

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ABSTRACT: In Himalaya region the geology is very complex as well as poor because of young mountainous region mainly sedimentary rock is encountered. As we know various methods are invented to construct the tunnel in India but in this paper we only discussed two important methods. In this paper we discussed on NATM (New Austrian Tunneling Method) and DRESS (Drainage Reinforcement Excavation Support System) in which NATM is mostly used in Himalaya region but DRESS is rarely used and only in Himalaya region due to extraordinary geological occurrence.

Keyword:-NATM, DRESS, extraordinary geology occurrence

INTRODUCTION

In India various modern techniques adopted for the tunnel construction. The techniques or method for excavating the tunnel is depend upon the type and properties of rock, faults, fold, stand up time are present in rock various factors are considered to construct the tunnel.

In this paper we discussed about NATM (New Austrian Tunneling Method) and DRESS (Drainage, Reinforcement, Excavation, Support System) method. We compared these two methods in this paper. Normally NATM method is used in everywhere in Himalayan region as well as in other area in India. And NATM is advanced type of drill and blast method. DRESS method is very rarely used in tunneling work. In Himalaya where the geology is not good in that situation DRESS method is used. DRESS method is used for tunneling construction in few tunnels such as Atal tunnel, Tala tunnel in Bhutan, Nathpa Jhakri tunnel.

NATM is used in such condition where predesigning is not advisable as well as economical perspective, also if we have to Change cross section drastically then we adopt NATM method. DRESS (Drainage, Reinforcement, Excavation, and Support System) method is adopted in such condition where unexpected geology is present.

METHODOLOGY

NATM (New Austrian Tunneling Method)

NATM is both a construction and a design philosophy. The philosophy is to use the strength of the surrounding soil to the extent possible to strengthen the tunnel structure. Another mean, ground condition drive the tunneling operation. The NATM philosophy promotes constant monitoring.

The NATM doesn't correspond to specific operations of the face during excavation nor to the use of a specific piece of equipment. NATM is adapted to each project and it is often updated during excavation in order to changes in geometric conditions and the nature of the ground. NATM method makes extensive use of shotcrete for the temporary liner in an attempt to optimize both the amount and timing of support.

NATM has shown the main seven elements which gives exact idea of NATM method

Exploitation of the native rock mass- Relies on the inherent strength of the surrounding rock mass being conserved as the main component of tunnel support. Primary support is enabling to the rock to support itself.

Shotcrete protection- Loosening and excessive rock deformation should be minimized. This is achieved by applying a thin layer of shotcrete immediately after the excavation.

Measurement and monitoring- Deformations of the excavation must be carefully monitored. NATM requires installation of sophisticated measurement equipment. It is fixed in lining, ground, and boreholes. In the event of observed movements, additional supports are installed only when if required.

Flexible support- The primary lining is thin and reflects present strata condition of rock. Passive support is used rather than active support and the tunnel is strengthened by a flexible combination of rock bolts, wire mesh and steel ribs, not by a thick concrete lining.

Closing of the invert- Especially crucial in soft ground, the quick closing of the invert (bottom portion of the tunnel) which creates a load-bearing ring is important and it has the advantage of appealing the inherent strength of the rock mass.

Contractual arrangements- NATM is based on monitoring measurements, changes in support system and construction method.

Rock mass classification, ranging from very hard to soft rock it gives idea about the suitable support required while avoids economic waste which comes from strong support. Support system designs exist for each of the rock classes is dissimilar. These guidelines are served for reinforcement of tunnel.

DRESS (Drainage, Reinforcement, Excavation, Support system)

DRESS method is rarely used to excavation of tunneling where the extraordinary geological condition is present. Normally extraordinary geology is present in northern of India Himalaya region. We determined the type of geology on the basis of various methods such as RQD (Rock quality designation), Q-system, RMR (Rock mass rating) etc. as well as other geotechnical investigation is also carried out to determine the geological data to adopt suitable method or tunneling. Rock classification is done on basis on classes (6 classes) other than this I some condition the geology is more than class 6 types rock this type of rock which is called as extraordinary geological occurrence. Extraordinary geological occurrence (EGO) is nothing but the flowing condition of rock (Slurry form). This type of rock strata which cannot mug by any truck or shovel so pumping technique is adopted to remove the mug from tunnel. For this EGO type geological condition the method which is invented is DRESS method. DRSS method is adopted in very few tunnels in Himalaya region such as Nathpa Jhakri and then in Tala tunnel, Bhutan but first trial is done on Maneri valley on that time DRESS method is not fully developed. DRESS method is only adopted where the geology is extraordinary like rock is in flowing condition and high shear zone area.

In DRESS method explained

D= Drainage

R= Reinforcement

E= Excavation of rock

SS= Support system

This all parameters are used in very particular and proper way in order to have stability because the geology condition is worst so all these activities are done in very proper way.

DRAINAGE

Unless drainage is done properly the water from the rock or strata will not be removed and it will be problematic in all the time during construction of tunneling. Drainage is done with the help of long whole is required to drained out the water. It done with the help of proper pumping system, proper dewatering system, proper channelization of the water required depending on the situation and ground condition.

REINFORCEMENT

Reinforcement is very main item to support the rock in order to excavation and support is done side by side because unless you do the excavation support cannot be provided. So reinforcement is protecting the roof and side of tunnel by squeezing and stabilizes the tunnel.

EXCAVATION

For Excavation is done in very proper way generally drilling and blasting method is very rarely used in the DRESS system if there is hard strata, boulders or big boulders encountered then only drill and blast method or extremely controlled gelatin otherwise excavation is done with the help of mechanical equipment, mechanical hammer, hydraulic hammer to material removed. Excavation is done with this mechanical equipment and rock is excavated and the progress is controlled because even the rock is beyond class 6 type (flowing type) rock. The progress is required to be taken only 0.4m or 0.5m per cycle not more than that so the support causes the problem.

SUPPORT SYSTEM

After the excavation work is being done support are provided immediately there because the rock is flowing condition rock so rock bolting is not possible even wire mesh but shotcrete can be possible in some time. Where the water is forcefully coming into tunnel then shotcrete and it can be channelized in a proper way. Fore poling is mandatory while excavation is carried out to support the collapsing rock. Fore poling is nothing but creating umbrella of reinforcement rock with the help of pipe and the length of pipe are provided is almost 8m to 10m with the inclination of 8 degree. Once pipes are grouted upto when you feel weak rock there but it all depends on the condition you encountered then the shotcrete as well as grouting is to be done along with the excavation.

CONCLUSION

As we discuss NATM and DRESS method in this paper we conclude that in area where good geology is encountered like hard strata we adopt NATM method because boulder is available in this strata after excavation but in DRESS method which only adopt in few tunnel and this tunnel are only in Himalayan region present sedimentary rock. If the geology is very poor or worst like strata is flowing type only in that situation DRESS method is best to tunnel construction. Other than extraordinary geology occurrence or flowing type rock encountered DRESS method is not adopted.

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